

Study Guide

For use with pages 305–312

GOAL Find probabilities.**VOCABULARY**

The possible results of an experiment are **outcomes**. An **event** is an outcome or a collection of outcomes. Once you specify an event, the outcomes for that event are called **favorable outcomes**.

The **probability** that an event occurs is a measure of the likelihood that the event will occur.

A **theoretical probability** is based on knowing all of the equally likely outcomes of an experiment. A probability that is based on repeated *trials* of an experiment is called an **experimental probability**.

When all outcomes are equally likely, the ratio of the number of favorable outcomes to the number of unfavorable outcomes is called the **odds in favor** of an event. The ratio of the number of unfavorable outcomes to the number of favorable outcomes is called the **odds against** an event.

EXAMPLE 1 Finding a Probability

A jar contains 15 red marbles, 16 blue marbles, 5 yellow marbles, and 10 green marbles. You randomly choose one marble from the jar. What is the probability that you choose a green marble?

Solution

Because there are 10 green marbles, there are 10 favorable outcomes. There are $15 + 16 + 5 + 10 = 46$ possible outcomes.

$$\begin{aligned} P(\text{green marble}) &= \frac{\text{Number of favorable outcomes}}{\text{Number of possible outcomes}} \\ &= \frac{10}{46} = \frac{5}{23} \end{aligned}$$

Answer: The probability that you choose a green marble $\frac{5}{23}$.

EXAMPLE 2 Finding Experimental Probability

You surveyed 65 randomly chosen students. Of the students you surveyed, 25 went camping during summer break. Find the experimental probability that the next randomly chosen student went camping during summer break.

Solution

$$\begin{aligned} P(\text{camping}) &= \frac{25}{65} \begin{array}{l} \longleftarrow \text{Number of successes} \\ \longleftarrow \text{Number of trials} \end{array} \\ &= \frac{5}{13} \quad \text{Simplify.} \end{aligned}$$

Answer: The experimental probability that the next randomly chosen student went camping during summer break is $\frac{5}{13}$, or about 0.38.

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Exercises for Examples 1 and 2

1. A drawer contains 12 white socks, 4 red socks, 6 green socks, and 10 blue socks. You randomly choose one sock from the drawer. Find the probability that you choose a red sock.
2. You are playing darts. Out of 45 attempts, you hit the bull's eye 18 times. Find the experimental probability that you hit the bull's eye on your next attempt.

EXAMPLE 3 Using Probability to Make a Prediction

Of the last 40 table-tennis games you played against your brother, you won 16. Use experimental probability to predict how many games of the next 20 you will win.

Solution

- (1) Find the experimental probability that you win a game.

$$P(\text{win}) = \frac{16}{40} = 0.4$$

- (2) Multiply the experimental probability by the number of games you are going to play.

$$0.4 \cdot 20 = 8$$

Answer: If you continue to win the same fraction of table-tennis games against your brother, you will win 8 of the next 20 games.

EXAMPLE 4 Finding the Odds

You randomly choose a letter from a bag containing one of each letter of the alphabet. What are the odds in favor of and the odds against choosing a vowel?

Solution

There are 5 favorable outcomes (a, e, i, o, u) and $26 - 5 = 21$ unfavorable outcomes.

$$\text{Odds in favor} = \frac{\text{Number of favorable outcomes}}{\text{Number of unfavorable outcomes}} = \frac{5}{21}$$

The odds in favor of choosing a vowel are $\frac{5}{21}$, or 5 to 21. The odds against choosing a vowel are $\frac{21}{5}$, or 21 to 5.

Exercises for Examples 3 and 4

3. Of the last 25 foul shots you attempted, you made 15. Use experimental probability to predict how many foul shots out of the next 5 you will make.
4. You spin a spinner that is divided into 20 equal parts. Six parts are orange, 8 parts are white, 3 parts are black, 2 parts are red, and 1 part is blue. Find the odds in favor of and the odds against spinning white.